

The Way Coins Are Made

A Rare Visit to The United States Mint

IN THREE CHAPTERS

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A Rare Visit to The United States Mint

CHAPTER ONE

January 23, 1853

BUT FEW PERSONS have any adequate idea of the various processes through which the precious metals pass from the time they are taken from the mines of Peru and South America, and from the auriferous gulches, river beds and mountain sides of California or Australia.¹

Many imagine that the bright metal, after having been raked together in the wilds of our modern Ophir,² at an immense expense of health, toil and comfort, has nothing to get through upon its arrival at the Mint,³ but a single melting in an iron pot, or some other convenient utensil, to be then cast into bars, then rolled into sheets, and finally to be cut into circular pieces, which only need a little squeezing under [in] a press to become current coin.⁴

We are somewhat reluctantly compelled to assure the unsophisticated reader that his ideas upon this subject are very contracted. We humbly acknowledge, at the same time, that until quite recently we were quite ignorant upon the same subject, and with a view to our own enlightenment and the subsequent edification of our readers, we have, within a few days,⁵ paid a visit to the Mint in this city, where, under convey of a gentleman⁶ profound in all the mysteries of melting and refining metals, and of coining money, we explored the multiform mysteries of the institution, and learned much of the art we are permitted by law to teach, but not practice.⁷

Without further preliminary remarks we will enter at once upon the discharge of our assumed task. We will first visit the Bullion Room, which is an appropriate starting point in our journey of exploration.

THE BULLION ROOM is simply a modest looking office, with a counter, a desk, a set of account books, a pair or two of scales, and a few ordinary fixtures. There is a

gentleman⁸ in this room whose duty it is to weigh each parcel of gold dust or other bullion as it is received. After making an entry of its reception in a book⁹ kept for the purpose, he makes a note of the condition of the deposit in case there is an unusual quantity of dirt or quartz among the "dust."

After this matter has been satisfactorily arranged, the depositor receives a certificate, or receipt, for his "pile," and he is directed to call in the course of a few days, by which time the precise value of his deposit will be ascertained. There is a contingent fund, out of which the owners of bullion are paid their claims as soon as their exact amount is fixed.

The California gold dust generally reaches the Mint in strong tin boxes,¹⁰ which, for the additional security of their precious contents during their long and somewhat hazardous journey, are covered by stout wooden boxes, which are generally made of the aromatic cedar of the country.¹¹

Bullion is also received in strong linen, or buckskin bags,¹² which are securely tied, and to "make assurance doubly sure," are so sealed that they cannot be opened without detection. The bags could be cut or carried off entire, and so might the boxes; one plan is, therefore, about as safe as the other.¹³

The "dust" of each depositor is kept strictly apart in a metallic basin which is numbered. After the deposit has been melted, and the average strictly assayed, its precise quality and value is fixed, and the depositor is paid for his gold, which then becomes the property of the institution, and is thrown into the general stock of the establishment. No deposit of a less value than one hundred dollars is received at the Mint.¹⁴

THE SCALES used in the institution are most critically exact. They are of the different dimensions suited for weighing any mass of metal between five thousand ounces and the thousandth part of a grain. We tried some experiments with several quite heavy scales, and found them so exceedingly sensitive that a piece of ordinary writing paper, no larger than a half dime,¹⁵ exercised a very decided influence upon their beams.

The weights used are the Troy ounce,¹⁶ and its decimals; the ounce being the unit which is divided into tenths, hundredths, and thousandths. The presence of so much gold, and their familiarity with it, appears to have made the officers so excessively nice, and above the common in their ideas, that even the vulgar fractions are discarded, and all the accounts of the establishment are kept in decimals.

The ancient term of "carat," so generally used (and so little understood) in describing the fineness of gold, has also been laid aside, and the favorite decimal is now used in its stead.¹⁷ This system has been pretty generally adopted in Europe, and the

change has been attended with an important simplification of money and bullion accounts.

The new system of describing the fineness of the precious metal is so simple that we endeavor to describe it. Pure gold is represented by 1000; if ten percent of alloy is added to the weight, it reduces the quality of the metal to 900. If five percent is added, the gold is then 950 fine, or five percent below standard.¹⁸

To illustrate the system further: if equal parts of pure gold and copper are mingled together, the mass is then 500 parts gold and 500 parts alloy; it would consequently be fifty percent below standard, and would be described as 500 fine.

BEFORE going into the mechanical department of the institution, we will glance over the accounts, which are kept in a peculiar manner. The Treasurer keeps an account with the Chief Coiner, and with the Chief Melter, and a reference to his books, and to those of the other officers, furnishes us with some interesting statistical facts.¹⁹

We find that from four to seven millions of dollars in gold bullion is received at the Mint each month throughout the year. From twenty thousand to thirty thousand dollars in silver bullion is usually received during the same period.

The Chief Coiner's account gives us the full particulars of the receipts of the precious metals, their quality, &c. We also ascertain from this authority, the number of pieces of different value which have been coined during a given time.

We learn, too, that in the course of operations which involved the manufacture into coin, of gold bullion worth not less than \$92,000,000, the total loss from wastage, in the coining department, was only three hundred and eighty-nine and a half ounces.²⁰ When we consider the manifold operations and the number of hands through which each piece passes in its career through the establishment, the smallness of the loss is a subject for marvel.

WE WILL NOW accompany a pan full of gold dust to the Deposit Melting room, where it will be melted into bars of a convenient size and shape. This room is paved with brick, and is surrounded with fierce furnaces, which look like the sugar bins usually ranged along the walls of retail grocery stores. Each deposit is numbered, and each pan containing gold dust is accompanied by a ticket, which bears its appropriate number.

When the melter gets a lot of dust into his hands, he places the ticket in his mouth, and the bullion into a black lead crucible; a portion of borax is then added by way of a flux, and to separate the impurities from the metal, the entire mess is deposited in one of the fiery bins before described. In a short time the fierce heat of the charcoal fire reduces the whole to a fluid mass.

WHILE THE GOLD is suffering great torture in the crucible, an iron mould^{21,22} is well greased to prevent the precious metal from sticking. By this time all is ready for pouring.

If the lot in process of melting is quite small, and amounts to no more than the trifling sum of three or four thousand dollars, the crucible is lifted bodily -- by means of tongs of peculiar shape -- out of its fiery bed, and its contents are poured at once into the mould²² prepared for its reception.

The precious metal, even in its fervid agony, will submit to no coarse contamination, and the grease inside the mould²² is speedily set on fire and destroyed. Gold soon cools, and the contents of the mould are turned out in a solid wedge of the coveted metal.

The borax, when melted, floats upon the top of the molten mass. When cold, the flux is found entirely detached from the wedge of gold, and the impurities of the metal are discovered mingled with the borax. This seemingly worthless matter is not thrown away; particles of the precious metal cling to it, and it is afterwards submitted to a separating or gleaning process to reclaim all the minute and fugitive grains.

After the newly formed ingots has been allowed time to cool, the melter refers to the ticket in his possession, and then stamps a corresponding number upon the auriferous lump.

The next operation is to chip off from the ingot a small piece of the gold. This fragment is also marked with the same number; it is then placed in the hands of the Assayer, who is able to decide upon the fineness of the entire mass by testing the specimen he has received.

The Assaying Department is a highly important branch of the institution; before closing our investigations we will pay it a visit, and will describe the interesting process by which the exact purity of a mass of metal is ascertained.

SILVER is the native alloy of gold, it generally contains ten or twelve percent of that metal. Platinum and iridium are also frequently present in small quantities. There is also more or less of the magnetic oxide of iron, or black sand,²³ invariably found among the fine scale dust of California.

In the early days of the discovery of gold in that country, black sand was found in much larger quantities than at present. Some of the knavish dealers put this trash into

their dust to make it weigh heavier. Those who deal in the article are now too well acquainted with the trick to be duped, and purer gold dust is the result.

Platinum is a very pure, and a very valuable metal. Iridium is the article which is used in making the diamond points of gold pens. This metal is found in small grains; it is so hard as to resist the action of the fiercest fire, and it cannot be operated upon by the most finely tempered file.

When iridium²⁴ is used for the points of pens, the proper sized particles are selected; they are soldered on to the gold, and cannot be affected by any tools in use.

THE MELTING ROOM at the Mint was quite a novelty to us, who have had so few opportunities of handling "filthy lucre." Our financial education has been much neglected, and our ideas of gold, in point of quantity, particularly, we discovered had been decidedly limited.

We had long been accustomed to see it spread out in marvelously thin sheets, and making a most prodigious show upon a very small capital, upon the frames of pictures and looking-glasses, and upon showy signboards; we had seen what we innocently imagined were extensive displays in jeweler's windows, and upon the waistcoats of flashy gentlemen.

We had been accustomed to consider the proprietor of a gold watch as an individual of superior consequence, and the sight of a handful of golden eagles²⁵ would at one time have inspired us with a feeling of respect for their owner as a man of substance.

Since our visit to the Mint these delusions have vanished, and we have imbibed a feeling of contempt for these things as small matters. In the Melting Room we saw great pans full of gold dust, and beheld huge crucibles of the molten metal, boiling and seething, while stout men, with begrimed faces, and with their right hands and arms shielded by enormous padded mits [sic! mitts], were ladling out the precious fluid mass with as much unconcern as though it had been a mess of homely broth.

In this apartment gold was not placed daintily upon velvet cushions, ensconced snugly behind plate glass windows, or half swathed in cozy quarters in the midst of soft raw cotton. In the Melting Room it was to be seen in huge wedges, solid and heavy, and in great lumps, which were thrown upon the dirty floor, and kicked and tumbled about with as much unconcern as by any means of the slightest importance.

It caused a curious sensation to pick up one of those dingy ingots of metal, and to reflect that we held in our hands enough of the raw material to purchase either a handsome house, the hand of a woman of the world, the soul of a politician, or almost any other marketable commodity.

WE WILL NOW REPAIR to the Melter and Refiners' Melting Room, which occupies an adjoining apartment. Here the precious ingots, which have in the meantime been assayed and valued, are brought, as a starting point in their road, to the high dignity of current coin.

The apparatus for melting in this room is precisely the same in character as that in the room which we have just left. It is more extensive however; no small lots of bullion are melted here, great bars of gold, worth in the aggregate hundreds of thousands of dollars, are melted at once.

We will now witness the first step in the nice chemical process which is designed to separate the ten or twelve percent of silver, before spoken of, from its more precious consort. The operations through which the metals pass are so complicated and scientific, and they have ere now been explained to us in such a world of high sounding technicalities that we had almost despaired of being able to convey any comprehensive notion to the reader, who is, doubtless, as inexpert in high art as ourselves.

Our guide, in the present instance, is a gentleman learned in chemistry, and so good a teacher withal, that we are tempted to essay a description from the impression made upon our minds by his happy illustrations and familiar style of conveying profound knowledge.

The first part of the interesting process we are about describing, is to add sufficient silver to the gold to make a mass two parts silver and one part gold. As the object is to separate from the gold the small percentage of silver it already contains, this movement is calculated to strike the unskillful beholder as rather a peculiar proceeding. We have it in our power to explain this apparently inexplicable enigma, and we will do so in a future stage of the proceedings.

After the two metals have been melted together and thoroughly mingled, the contents of the crucible are turned, while in a molten state, into vessels containing water -- the consequence of this is a terrible hissing and spluttering in the aquatic element, and a complete granulation of the metallic mass. The latter result was the object of the operators, and after this has been attained, the glittering grains are carried up stairs into the refinery.

Before following the precious seed into the chemical department, we will take a further survey of the Melters' Room. The floor of this apartment is compactly paved with stone; over this floor there is a lattice work of iron, cast in hexagonal sections, and so arranged that it can be taken up and laid down again at pleasure.

This is an ingenious device to prevent the workmen and visitors from carrying off on their shoes the precious particles which fill about the floor and become mingled with the dirt and dust. The sweepings of the rooms, and many other seemingly worthless matters about the establishment, are carefully preserved and refined. We have some

curious facts to mention in connection with this branch of our subject, and will enlighten the reader concerning these same "sweepings," before concluding our sketch.

WHEN GOLD or silver in coin or ductile bars are received into the Mint, their quality is ascertained, they go direct into the Melting Room, without passing through the same formula as gold dust. According to the present government standard, all American gold and silver coin, with the single exception of three cent pieces, contain ten percent of copper alloy.

The three cent pieces²⁶ are more extensively alloyed, and consequently leave a margin for a good profit to the Government. After alloying the metal, it is always assayed again to ascertain whether the mixture is exactly right.

WHEN FOREIGN COIN,²⁷ or bars of bullion, go direct into the Melting Room, they are always seasoned by the Assayer; that is, if they are above standard and more than nine hundred fine, they have a morsel of Lake Superior copper added to reduce the quality, just as a careful cook would put a drop of water into her cooking, if it was too rich.

If the metallic broth is poor, and below the standard mark, a lump of good butter, in the shape of a wedge of fine gold, is put into the mess, and it is then ready to go into the pot. We must confess to a little grossness of taste in this matter, and to a disposition to partake somewhat largely, without a very nice discrimination, in the secondary point of "seasoning."

WE WILL NOW repair to the second floor of the building, and after picking our way through files of portentous looking carboys of nitric acid, with which the passages and galleries are lined, we are ushered into the Refinery.

The olfactories are saluted at the door of this apartment by a most suspicious order of chemicals. We know something of the deleterious effects of the fumes of certain drugs, and hesitate about entering the room. Our scientific guide assures us that the escaping gases are entirely harmless, and we venture in.

This room is very large, and is extensively lumbered with vats, tubs, &c. There are here several large boxes, which reach from the floor to the ceiling, and are aptly enough called "houses." They are glazed, and present a particularly dingy and uninviting appearance.

An attendant kindly raised the glazed doors of one of the "houses," and afforded us an opportunity to peep into the mysteries of the place. We almost fancied, at the first

glance, that there was some mistake about the matter, and that our guide was showing us an improved cooking apparatus.

There were fifty enormous porcelain jars sitting in a hot water bath, with their contents boiling at quite a furious rate; instead of steam from them, a peculiar looking orange-colored vapor was rapidly disengaging itself from the pots, and was curling upwards, through a flue, towards the great chimney of the Mint, by which means it finally escaped into the open air.

We now learned that the granulated masses of gold and silver, which had preceded us to the Refinery, had been put in these cauldrons, and that nitric acid,²⁸ in the proportion of a pound and a half of the chemical to one pound of metal, had been poured over the mass. This was complete martyrdom for the silver.

The acid either cares nothing for gold, or it cannot digest it, so it attacks the silver and ravenously devours it, while the gold sinks to the bottom of the vessel, and is no way incommoded by the hubbub. After five hours' hard boiling, the broth is allowed to cool, and the liquor, which has now become the nitrate of silver, is set aside to cook up with a fresh lot of granulated metal.

The gold has settled to the bottom of the pot, where it lays black and dirty, and looking amazingly like the sediment in a housewife's coffee-pot. There is some little silver left in this sediment, but there is no escape for it, and the grounds have to be boiled over again to get out the last remnant of the persecuted metal. A fresh dose of nitric acid is now poured into the jars, and they are again set to boiling, and after about a day and a half occupied in this second cooking, the last morsel of the wretched silver has been devoured by the hungry acid, and the gold is left in its more than native purity.

When we visited the Refinery, there was more than a million of dollars worth of metal in full boil in the houses described above. The legal interest upon this lot of lucre, during the forty-eight hours it was boiling in nitric acid, was not far short of four hundred dollars.²⁹

WE NOW LEARN why more silver was added to the gold before the process of granulation. Gold does not care a straw for nitric acid, and were a portion of that metal containing a small percentage of silver put into the chemical, the gold would resist the acid, and would not suffer it to get below the surface and drag out the unfortunate silver.

Its only effect would be to eat the particles of silver out of the surface, and thus create minute superficial molecules. The chemist goes upon the principle of dividing to conquer, and accordingly diffuses the fast friend of the silver through a large mass of the latter; by this means the gold has enough to do to take care of itself, and the silver is absolutely given over into the hands of its insatiate enemy.

There are several vats in this room; they have perforated bottoms, over which several thicknesses of muslin are placed, with the edges brought up to the top of the vat and there tacked.

The golden sediment from the porcelain jars are emptied into these vats or filters, and a stream of pure water is let on to the mass, which, in a few hours, is washed free from any remnants of the nitrate of silver. The gold is allowed to drain for a time after being washed; it is then to be pressed and dried to extract all the moisture from it, and the pure atomic metal is ready for the crucible.

We saw several tubs containing many hundreds of thousands of dollars worth of the desired metal. It looked more like coffee grounds than any other substance to which we can compare it. If it was placed upon the sidewalk of a crowded street, it would probably remain unheeded until carried off in the carts of the scavengers.

THE SILVER, which has had so much to endure, is not yet out of its troubles. After coming out of the jars in which it was so harshly treated, the silver has become a nitrate, and is put into leaden vats, and chloride of sodium – or in other words, common salt -- and water are added; this addition of salt precipitates the silver, and turns it into a chloride. This is washed free by a copious supply of water, and the mass is then put into a vessel of water, and the mass is then put into a vessel with granulated zinc, and a portion of sulfuric acid is added; this sets the mixture to boiling by its own heat; chloride is discharged, and the hydrogen escapes in a vapor.³⁰

The entire mass is afterwards put into filterers, and it is well washed by a constant stream of water running through it. The zinc becomes sulphate of zinc and goes off, leaving the remainder pure metallic silver in an atomic state.

We must beg the reader not to imagine for a single moment that the result of these varied operations looks in the least like silver. Far from it. Conceive the appearance of a bed of plastering mortar, and you have a very correct idea of the condition to which the poor shattered metal has been reduced.

In the next stage of the proceedings, the metallic mass has become somewhat drier, and is placed in tubes to drain. The contents look much like damp coal ashes, and would not for a moment be suspected of being worth \$10,000, which, we are assured, is the value of the contents of each tub.

THERE IS A ROOM below into which the wastewater of the refinery runs; it is not suffered to escape, however, until every pennyworth of the precious metals which it contains have been extracted from it. The silver has yet another painful operation to undergo, for from the refinery it is lowered down into the basement, in the ten thousand dollar tubs already spoken of.

It is here ran alongside of a workman, who is armed with a cast steel scoop, with which he shovels out the mass into a cylinder. It is then submitted to the action of a powerful hydrostatic press, which squeezes out all the moisture from the metal, and compresses it into complete silver cheeses weighing fifty pounds each, which would make a capital accompaniment to the figurative staff of life spoken of by poets.

After the operator at the hydrostatic press has got through with the "cheeses," they are carried to an oven, where they are more perfectly dried, and they are then ready to be broken up, melted and run into bars to pass through the same dreadful ordeal over and over again.

Having furnished our readers with all the matter (for which we could find room in this week's Dispatch), concerning this great coin-making establishment, we will postpone the further description of the institution until next week, when we will continue our explorations, and will give the reader the benefit of our sagacious research.

CHAPTER TWO

January 30, 1853

IN OUR LAST, we informed the reader somewhat the tribulations endured by gold and silver before those metals were even considered presentable objects for the politeness of the machinery which gladly assists in their manufacture into coin. We set forth the manner in which the "pile" of each Californian was operated upon by the officers of the Mint, after it was deposited.

We traced it to the melting room, and showed how the treasure of each man was specially melted by itself, in order that there should be no mistake about its value. We said that a piece of the deposit was taken by the Assayer, who, keeping an account of the mark and number, passed it through certain operations, in order to settle its precise fineness.

This business of assaying we did not then describe, but, going on with the subsequent history of the treasure, we told how, after the claim of each depositor was correctly ascertained, the various parcels became the property of the Mint, and the aggregate of many lots of metal being placed together, were melted up with silver, granulated by being cast into cold water, and then submitted to the tortures of strong nitric acid, which detached the silver from the gold, leaving the latter entirely pure.

The next task was to reduce the fine gold by alloying it, so as to bring it to the standard for current coin; and after this was done by the admixture of silver or copper, as the case might require, the mass was again cast into bars. It would now be ready to undergo the subsequent ill treatment which is yet before it, were it not that the Assayer is a peculiarly suspicious gentleman, who is always busying himself about the condition of the metal.

Nothing can be done until he certifies that the mixture is of the proper consistency, and that there has not been too much liberality, or too much stinginess, in putting in "the seasoning." He therefore assays the metal again -- and as the process in this instance is precisely the same as was used in the first place to ascertain the value of the Californian's single "pile," our description will give a good idea of both assays.

The affection between silver and gold is so great that they mingle in wedlock with the tenderest pleasure. So much attached are they, that when they are joined in equal parts, the difficulty of divorcing them is considerable. In order to separate them thoroughly, the minters do not hesitate to encourage bigamy, and usually join double the quantity of silver to a given measure of virgin gold.

Sometimes they do not hesitate at polygamy, and give to the yellow metal three

times its own weight of the white treasure. The Assayer is willing to assist the loves of the metals, and, in fact, he takes advantage of their fondness for each other to compass his own designs. He knows perfectly well that the effect of fire upon them is to blend them intimately and thoroughly.

The action of heat so mingles them together that there is not the slightest preponderance of either metal in any part of a bar. The gold does not slip away from the arms of the silver and lie in one corner of the fiery bed; even the copper behaves itself exceedingly well under the circumstances, and mixes with its companions with the utmost freedom. It therefore follows -- and long experience has demonstrated the matter beyond the possibility of a doubt -- that any part of the molten mass is a just representative of the condition of all the metal which was in the crucible.

The Assayer is a dainty manipulator. He does not care about troubling himself with testing every bar of gold in the general melting which usually follows the newspaper announcement, "Ten days later from California -- two millions and a half in gold dust."

If John Smith, fresh from the diggings, all brown and brawny, comes to the Mint with the result of his experience in gulches, canons and coyotes, of course the precise value of his days and nights of toil is ascertained, in order that Mr. Smith shall not be defrauded of the produce of his labor; but, after Smith has been paid, and the "plunder" of Smith, Jones and Brown, has been melted, refined, alloyed, and melted again, and when the great messes of golden soup are poured out of the big pots, all that the Assayer requires is a small piece or two from the "haste plate" to settle to his own satisfaction the value of the whole.

From each depositor's bar or wedge, a small slice of metal is cut. From the general melting, pieces of gold are usually taken from two bars out of fifty or a hundred. Unless some peculiar reason interferes, the ingots thus selected are the second and that which was next to the last in casting.³¹

With these slips, thus secured and duly numbered, so that their identity can be traced during subsequent transmogrifications, the Assayer repairs to his own department, where a solemn trial of the virtues of the metal is made.

THE ASSAYER directs his entire attention to the method best suited to ascertain to a nicety the precise purity of the gold. To do this, he has the most delicate scales, and the tiniest weights, in the world. His great weight he calls "unity." It is a test measure by which all his calculations are made.

It really makes no odds to the reader how heavy "unity" is, because it is a relative measure, but in order to satisfy curiosity on that point, we may say that it is as heavy as a French half gramme,²² which is about seven and three-quarters grains.

The little weight is subdivided into tenths, hundredths, thousandths, and ten thousandths, in order that precise accuracy may be attained. The ten thousandth is the smallest specimen of a weight ever seen.

If the reader will imagine a silver wire thinner than the finest hair in his head, and then suppose it is cut to a length less than an eighth of an inch, he will have some notion of the appearance of the one-ten-thousandth of "unity."

To distinguish them, these wee measures are bent, some at right angles, some into triangles, others in squares, and sundry odd shapes. They are handled by dainty pincers. It requires good eyesight to distinguish some of them, and it will readily be supposed that the scale which is moved by such infinitesimal particles is very delicate indeed.

Truly, it is; and to keep it in order is a matter requiring care. It is placed in a frame surrounded with glass, and when it is used, after it is loaded with the metal, the doors are closed down. If in summer time the gentle zephyr were to steal through the room, it would disturb the scale.

If the weigher was even to sneeze in the most genteel manner, it would sadly affect the balance. A breath will cause it to swerve, and hence, when it works, it does so in a glass house, secure from the perils which generally threaten those who reside in such mansions whenever they feel disposed to throw stones at their neighbors.

THE BEAMS of these balances are made of palladium. Steel was formerly employed for that purpose, but it had too many bad habits to be long employed in the Mint. After the scale had stood for a while, ranging north and south, it was found that the steel beam acquired a magnetic dip, which disarranged the equipoise. Then too, it was liable to rust, and it cut so many capers that it was determined, some time since, to discharge it from the Assayer's employment.

Palladium cares no more for the north pole than it does for south-south-west. It does not bow to the magnetic influence which has its residence in the present neighborhood of Sir John Franklin,³² and as it does not oxydise²² and is of a low specific gravity, it was chosen for the delicate scales to which we refer.

From the slip of gold prepared for assay, the operator snips off sundry small pieces, until they are of the precise weight of "unity." He then takes just double that quantity of shavings of pure silver and adds to the auriferous lot. A piece of thin lead, of seven times the weight of the more precious metal, is then twisted up into a cornet, like those in which bonbons are kept.

The silver and gold are then emptied into the leaden envelope, and the whole is rounded down into the shape of a bullet. Caspar, the hero of "Der Freysebutz,"³³ was willing to sell himself to the free hunters for seven bullets of silver. In intrinsic value,

probably not one of them was worth as much as this specimen of the Assayer's ammunition.

Whether the munitions which the latter casts in his laboratory will produce more mischief than the charmed balls prepared in the Devil's Hollow, might be a question which the subsequent history of the minted metals would answer in the negative.

At all events the bullet is now prepared for the ordeal which it is to go through, and without philosophising²² on its fate when it wanders aboard into the world in the shape of coin, let us follow it through the laboratory.

A FURNACE, which glows with the fierce heat of charcoal fire, has placed in it a little clay oven, which is technically called "a muffle." The flames which surround it make it red hot, and give as a very good idea in miniature of the warm quarters into which Mons. Chabert³⁴ was wont, once upon a time, to freely venture.

The Assayer has ready prepared a small round white vessel, which is called a cupee.³⁵ It is made of phosphate of lime, which is obtained by burning bones and then grinding them fine. The vessel itself is exceedingly greedy in its taste, and of this infirmity the operator takes advantage.

A number of bullets, being placed in a number of cupels, are put into the glowing oven and the door shut for about twenty minutes. The lead melts at a lower temperature than the other metals, and soon envelopes them in the scalding bath. The silver and gold quickly follow it into molten fluidity, and whatever other metals are mixed with the gold also deliquesce.

The cupel has not the slightest objection to this; it only requires that a stream of fresh air shall be permitted to wander through the oven. This causes a rapid oxydisation²² of all the molten metals, except the silver and gold -- lead, tin, copper or iron, are all absorbed by the phosphate of lime, or find their way off in fumes.

In a short time nothing whatever is left but the pure silver and pure gold, which, being taken out to cool, soon hardens into "a button." This button is then hammered for a minute or two, until it is flattened out. The piece is put into an annealing furnace for three or four minutes to soften it.

It is then hammered again, and passed through a rolling press until it is squeezed into a slip about two inches long. All impurities being thus removed, the next process is to disengage the silver from the gold. The slip is stamped with its proper number, and then rolled up into a small spiral.

Near by, on a sand bath heated by a furnace, are already prepared a number of glass flasks in which pure nitric acid³⁶ has been placed. The spiral of silver and gold is

then put in this strong resolvent. We have seen that, in the process of treating a lot of gold and silver worth a million of dollars, the process is to disintegrate the metal into grains, so as to give the acid a better change of dragging the silver from the embrace of the gold.

The reason is because it is better economy in such large operations to use the smallest quantity of acid which will do the work. But in the Assayer's laboratory the manipulations are so delicate that there is no need of such niggardliness. Each spiral of metal is, therefore, immersed in so strong a bath of the nitric acid that the chemical penetrates every pore of the gold, and drags out the silver *nolens volens*.³⁷

When it is first introduced to this mixture, ebullition, but not boiling, commences; orange colored fumes escape, growing less dense until the poor silver is pretty much swallowed up. Real boiling succeeds, and after ten or fifteen minutes' suffering, the nitrate of silver is poured off.

Fresh acid is added to the gold, and another boiling takes place. The auriferous metal betrays no indignation at this; it changes color and becomes rather brown in its appearance, but that is all. When the second ordeal is gone through, the nitrate is again poured out of the flask, fresh water is poured in, and the spiral is washed free from its late tribulation.

But another process is necessary: the slips are placed in little clay crucibles, the annealing furnace is again restored to, and the gold comes out bright, yellow and resplendent in the utmost purity.

This was the consummation so devoutly wished, and the precise fineness is thus unerringly ascertained. The little spiral is brought back to the scale from which it first started, and is tested by comparison with "unity." Whatever it contained in silver, tin, copper, or iron, is thus learned precisely, and the present weight of pure gold indicates the fineness of the lot of which it was once a part.

Even platinum is discharged by the operation of the Assayer, for, although that metal pays no attention to the fiercest fire which can be kindled, it cannot fight *aqua fortis*,³⁸ which eats it up as well as the most digestible food. The nice, tiny weights, of which we have spoken in the commencement, are now put in play, and when the result is noted, the depositor gets a certificate of the value of his dust, with a return of the silver which it contained.

If the assay is of metal intended for coinage, a certificate is given to the Treasurer that the parcel is of the proper standard.

The nitric acid in which the spirals were boiled, take up the silver. It is clear and sparkling as spring water. To disengage the silver from the nitric acid, the Assayer uses muriatic acid³⁹ instead of salt and water, which is the usual process in the refinery. The reason is because the nitric acid is thus saved, and may be re-distilled and used.

WE HAVE THUS related the process in assaying gold. With silver which is intended for coinage, the modern process is different. Formerly, the "dry assay"⁴⁰ of silver, which much resembled the manner in which gold was treated, was the only method known. It was an uncertain plan, varying with the heat of furnaces, the condition of crucibles, and other matters which distributed [disturbed?] the manipulation.

In France, some years ago, it was discovered that the silver assays of various chemists differed much in standard, and it was therefore considered necessary to devise some better plan. Gay-Lussac,⁴¹ an eminent French savan, turned his attention to the matter, and invented what is called "the humid assay."⁴² This is a very beautiful process, and so accurate that mathematical nicely can be obtained.

The English Mint still clings to the dry assay, but in the United States Mint the humid method has been the only one used for the last fifteen years.

The great agent in this test is weak salt and water, which, we have hitherto seen, has a great effect upon the nitrate of silver. The silver to be assayed is, in certain quantities, exposed to the action of prescribed portions of nitric acid. The chemical agent swallows up the silver, copper, and whatever else may be contained in the slip which is to be assayed.

In one corner of the room in which this operation is conducted, and near the ceiling, is a reservoir which contains the necessary saline mixture. It has been settled by extensive experiments that certain quantities of the fluid will precipitate a given amount of silver when the liquor is mixed with the nitrate.

A spout and pipe from the large vessel leads to a glass chamber and tubs which is nicely graduated, and the measure is cut into the glass. The prescribed weight of silver and its alloy having been digested by the accurate quantity of nitric acid, it is known that a certain amount of salt and water being emptied into the nitrate will cause a well ascertained portion of silver to be precipitated.

The whole operation depends upon the proportion of salt and water, and so nice is the glass apparatus the neither a drop more nor less of the mixture need to be used. The Assayer graduates the fluid exactly, and it is then emptied into the bottle containing the dissolved silver.

The contents immediately turn as white as milk, and the metal begins to fall slowly in a powder. It would take a long time to do so if left to itself, but it has been discovered that, by a chemical paradox, it is only necessary to shake the mixture violently in order to detach the particles.

A little machine, large enough to hold a dozen bottles, is worked by the steam-engine. The motion is rapid and rough, and in a very few minutes it is discovered that the powdered silver is entirely freed from the nitric acid, and lies at the bottom of the bottles.

There may yet be some metal in the mixture, and the Assayer has a method of discovering. A quantity of salt and water, called a "decimal solution," which is only of one-tenth the strength of that in the large reservoir, is now carefully added in the proportion of one thousandth of a gramme.²² If any silver remains, it shows itself by a white film floating on the surface, which greatly and slowly sinks.

More of the solution is added if necessary, until the tests and counter-tests prove that every particle of the metal has been precipitated. So anxious is the silver to escape from the nitric acid that it will reveal itself in obedience to a drop of the saline solution, if even the fourteen thousandth part of a gramme²² remains.

This is certainly a most beautiful method of determining the fineness of silver, and it adds another proof to the many which we have of the astonishingly recuperating effects of a salt water bath.

BESIDES the two principal processes of assaying just described, there are two adjutant, or subsidiary ones, which become necessary, from the fact that gold bullion always contains more or less of silver, and silver bullion usually contains a small accompaniment of gold.

To determine the proportions of these, there are assays by cupellation,⁴³ which partake of the character of the process already describe, though requiring less time; and it may not be necessary to do more here than to state that they form a constant part of the Assayer's work and scrutiny.

While the delicate operations of the assaying room are in progress, a lot of gold, which has already been properly alloyed, is made ready for the Rolling Mill, whither we will now follow it. The metal has already been cast into bars, which is so simple an operation that a description would be a work of suprerogation.

After the bars come out of the mould²² in which they have been cast, they are "dressed up" by clipping off their rough ends, and filing off their "beards." This is done to prevent the ragged edges from injuring the workmen who are required to handle them, and to avoid the wastage that would be more likely to attend them if their wiry edge were allowed to remain on them. The clippings and filings can, of course, be put into the crucible without being again assayed.

WE WILL NOW accompany the prepared bars into the Rolling and Cutting Room, where they will be rolled out into sheets of the proper thickness for the coin for which they are designed, and finally be cut or punched up into "blanks" for coin. In this room there are a great number of Rolling Mills in active operation.

A Rolling Mill⁴⁴ is simply two steel rollers, which are made to revolve rapidly in the same direction. One end of a bar of metal is placed between the rollers; it is soon carried through, and its length and breadth are increased in proportion as its thickness is diminished.

The rollers are so contrived that they can be brought as close together as may be necessary. The bar of metal passes through various mills of different caliber, until it is sufficiently reduced in thickness to pass through the ordeal of the draw-bench.

There is considerable mechanism connected with the Rolling Mills, it being necessary that much precision should be used in regulating the thickness of the metal, and in graduating the rollers so as to accomplish the desired end.

THE DRAW-BENCH is simply a machine by which a strip of metal is drawn through an orifice of a certain size, which is fixed according to the denomination of coin to be made. This drawing contrivance seems like a terribly determined piece of machinery; it is furnished with a pair of jaws, well armed with steel teeth, which show no mercy, but do their master's arbitrary bidding without scruple.

A strip of metal from the rolling mills has had one end flattened by the action of an ingenious piece of machinery, and the strip has been well coated with melted beeswax. A workman places the thinned end of the metallic ribbon in the orifice, through which it must pass; one moment of dreadful suspense, and the savage jaws of the monster machine seize it, and away it goes, even though the passage is not half the size of the victim.

We could almost believe that if the orifice was not larger than an ordinary pin-hole, and the end of a well greased crowbar could be introduced, the machine would certainly convert the bar into an elongated wire. For silver or copper money, the draw-bench is the gauge [sic! gauge] for the weight of the coin.

The orifice through which the strips pass is regulated with much precision, and the thickness, as governed by its agency, is considered near enough for any practical use.

With gold, however, more nicety is required, and every piece is separately adjusted, so as to be critically exact. After the strips have passed through the clutches of the monster just described, a piece is clipped from the end of each, and examined to ascertain if it is exactly right.

If the strips "pass muster," they are then handed over to the tender mercies of the cutter, whose special duty it is to punch out the "blanks," or "planchets," with a circular chisel, which works with great rapidity, and riddles a strip of metal at the rate of two hundred and fifty "blanks" per minute. The precise officers take care, though, that three of the bright circlets out of each strip shall be weighed before the process of cutting goes on with.

It would be entirely useless for a bar or strip of metal, or even a single "blank" or coin, to attempt to "run the gauntlet" and pass through the establishment unless it is up to the standard in quality and weight.

Mint officers are a very suspicious race of men, and between their humid and dry assays, and their hypercritical scales, and their chemical tests, they give the inoffensive gold and silver a world of trouble, and seem to take a sort of savage pleasure in the discovery of any little defect or peccadillo that will justify them in sending these badly treated metals back to the terrors of the retort or the crucible, and to the martyrdom of furious charcoal fires.

Even in the Rolling and Cutting Rooms fierce fires are kept burning, to restore the temper which the metals are very apt to lose in the various hardships they are compelled to undergo, between the oppressive conduct of the rolling mills and the savage cruelty of the draw-bench.

When it is discovered that ill-treatment has made a strip of gold or silver sullen, harsh and intractable, a familiar seizes upon it at once, and with a heart full of cruelty he puts the persecuted metal into a copper tube, closes up both ends to prevent the approach of a mouthful of fresh air, and then, horrible to relate, places the victim into a fiery annealing furnace, where it is allowed to become red hot, and is then soused head and heels into cold water.

This severe treatment has the desired effect, and the poor broken-spirited metal yields in despair to every cruel exaction of its tyrannical task-masters.

AFTER THE LITTLE blanks have been punched out, and are guaged, [sic! gauged] and tried until there is "not a loop left to hang a doubt upon," they are -- without question, reluctantly enough on the part of the rollers, and drawers, and weighers -- given up to the lands of the ladies.

As the metal has passed through a great many dirty hands, it has become a good deal soiled, and it is in no condition to make its appearance before respectable society; it must therefore be washed and made to look as genteel as possible before making its appearance in the Adjusting Room.

For this purpose our persecuted little friends are carried into an adjoining room for the purpose of giving them a hot bath. Here they are soused into a vessel containing soap and water in a boiling state, in which they have to lay until their faces are washed clean and free from loose dirt or grease; this operation performed, they are rinsed off in pure schuykill,⁴⁵ and they are then dried by throwing them into a trough filled with hot saw-dust, in which they are stirred about, and finally sieved out clean and dry, but not yet freed from the stains of the bitter tears shed during their terrible experience.

We had fancied that the little bits of yellow metal would now be relieved from the mortifying system of espionage to which they have been subjected. In this we were mistaken. When the celebrated Fonche⁴⁶ was minister of the French police, no man knew whom to trust; spies were everywhere, and no one could breathe a treasonable thought without incurring the risk of the guillotine.

In the Mint, things are in about as deplorable a condition, for the suspicious officers have got a great party of young ladies whom they employ as spies, and whose duty is to weigh each piece separately, and to file off a portion of all which happen to be in the smallest degree over the standard weight.

It must, nevertheless, be an agreeable change to the little bits of gold -- who have endured so much from the persecutions of the sterner sex -- and a source of gratification to them when they find themselves in the Adjusting Room. There are here no flaming fires, ravenous chemicals, cruel rolling mills, nor savage draw-benches; upon the contrary, there is a room full of pretty girls, who have no more formidable instruments of torture than a little flat file, with which they rub away any superfluity of metal in a manner that must be rather agreeable than otherwise to the feelings of the little "blanks."

Each lady has a pair of nicely-balanced scales, in which she weighs every piece. When any portion is to be removed by the file, the "burr" is selected. The "burr" is the lower edge of the "blank," and is apt to be somewhat ragged from the action of the die in cutting out the pieces.

"Blanks" that are too light are condemned by the adjusters, and have to go back to the terrors of the crucible. They are certainly much to be pitied.

THE ADJUSTING ROOM differs in many respects from the other apartments in the Mint. In the rooms in which the male operatives are engaged, but few words are spoken, and the only sounds heard are the groaning, clanking and whizzing of machinery, and the musical clinking of bright coin. In the Adjusting Room there are fifty-seven females employed, mostly young and pretty girls.

It would be absolutely preposterous to expect such a crew to be silent when so many important questions pertaining to the beaux, to *de laines*, and to the most recently devised "love of a bonnet," are to be discussed. The buzz of busy girlish conversation, and the light laugh, are constantly heard in the Adjusting Room during working hours, but their task goes steadily on in the meantime, and forty thousand golden pieces are carefully weighted and adjusted there every ten hours.⁴⁷

No doubt this sojourn in the ladies' department is a pleasant episode in the journey of the little "blanks," and sorry enough they must be when they are gathered together once more to be weight in bulk, after passing through the taper fingers of the fair adjusters.⁴⁸

Before following the embryo coin down stairs into the Milling Room, we will take a further survey of the scene they are about leaving.

The room in which the females are employed is large and airy; it is furnished with three long tables, at which the girls can either sit or stand to work as they think proper. The bales are covered with paper, upon which the filings drop and are afterwards swept up by the fair operatives, each of whom has a leather apron which fits around the neck and reaches on to the table before her.

After all the dust that can be brushed together has been gathered up, the paper is laid by to be burned with the sweepings of the floor and with other matters, the ashes of which will yield a heavy percentage of gold. When the females quit work, they are very particular to brush off from their aprons, and their clothing, any particles which cling to them.

A good deal of the sparkling and precious dust is doubtless carried off and scattered in the air in spite of every precaution to prevent it. There is a dressing room, a kitchen and a dining room partitioned off from the main apartment. In the later, the girls take their dinner, and have every facility afforded them for brewing a comfortable cup of tea, and for making any other arrangement they may require at their meals. This, especially in bad weather, is exceedingly convenient.

WE WILL NOT intrude longer upon the privacy of the females, and will follow down stairs after our old friends. The [adjusted blanks] have by this time reached the Milling Room, where they are huddled into a press which mills them at the rate of five hundred per minute. The object of the milling is to raise upon the "blanks" the narrow rim or bold edge which encircles the coin.⁴⁹

This operation is performed by pressing the "planchet" between steel dies, which has the desired effect. In former days the fine ridge around the edge of the coin was placed there during the milling process. It is now done at the same time that the impression is put upon the face of the coin.

The poor little pieces of (almost) coin come out of the milling machine no doubt rejoicing in the prospect that their martyrdom is about to end, and that they will soon go out into the busy world to be courted, and sought after, and loved, and striven for, and, in short, to become the gods of man's heathenish idolatry.

But the sufferings of the blanks have been very great, and their poor faces give evidence of many a severe bruise and of the work of fire and deadly drugs. They have been purified, however, by the travail through which they have passed, and, after having their faces well washed of the stains and the traces of tears of anguish, they will come out of the dread ordeal bright and clear, and ready for the last stroke of the die, which will effect their apotheosis.

We will now witness the operation which cleanses and brightens the coin, and prepares it to go into the world to occupy the first place in man's affections. But, lest it should feel too much elated at its growing importance, it is deemed advisable to give it another humbling.

The blanks are accordingly put into iron boxes, which have double lids to exclude every portion of air; "blanks," box and all are then put into a fiery furnace and kept until they become red hot. The boxes are then taken out of the fire and are emptied into diluted sulphuric acid, which cleans the faces of the blanks. The acid is washed off in fair water, and the blanks are once more emptied into the troughs with the hot sawdust, where they are stirred and sieved and manipulated until they are cleaned and polished, and bear a most beautiful lustre and color.^{50, 22}

They have only to submit to a single squeeze under the die, and they are then through with their troubles, and ready to go forth to swell the rich man's hoard, to gladden the widow's heart, to reward the virtuous and laborious, to pander to the vicious and depraved, to be "the root of all evil" the fountain of much good, to be one the greatest curses, and the greatest blessings, ever vouchsafed to man, and to be, in fact, the great main-spring of society.

THE PRESSES in which the coin receives its appropriate stamp are beautiful pieces of machinery; they are contrived to do their work rapidly and accurately, and will vie with any coining machines in Europe. They were chiefly manufactured at the Mint, and have furnished models to the world.⁵¹

The principle upon which the presses work is a joint or hinge, which is straightened and bent by an ingenious arrangement. The straightening of the joint presses the coin tightly under the end of the limb, and brings it in such forcible contact with the die that the impression is secured. The banding of the joint relieves the coin from the pressure, and it is dropped into a receptacle prepared for its accommodation; in the meantime another planchet has been deposited in the die by the action of two steel fingers, which take hold of the blank, retain it in its place, and act throughout quite intelligently and dexterously.

The blanks are coined as rapidly as the joint can be straightened and bent. The steel dies, on which the impressions upon the coin are given, press the blank into a steel "collar," which is notched to make the fine ridges around the edge of the coin.⁵²

There is an ingenious and simple contrivance by means of which the blanks are laid upon the edges in regular rows or rolls, to feed the milling machines and coining presses. It is called a "Shaker," and consists of a wooden box with its bottom cut in grooves to suit the size of the coin to be "shaken."⁵³

The presses are fed through a tube. If the blanks had to be picked up and arranged in roleaux,⁵⁴ by hand, to drop into the tubes, it would require several persons to feed each press. With the arrangement spoken of above, a parcel of blanks and placed in a "shaker," and shaken quickly; this causes the blanks to arrange themselves in regular order in the grooves in the bottom of the box, and a single workman can take them up in piles as large as he pleases, and he is enabled to "feed" a milling or coining press as rapidly as its ravenous maw can digest its metallic food.

The operations of rolling, cutting, milling, cleaning and coining silver and copper coins, are precisely the same as those through which gold passes. More accuracy is required with gold, and the services of the adjusters are dispersed with in the meaner metals.

It is impossible to finish our sketch of the Mint in the present number of the Dispatch. In our next we will conclude the sketch, and will strive to enlighten our readers concerning various matters not yet touched upon in connection with the institution, its history, working, &c, &c.

CHAPTER THIRD

February 6, 1853

IN THE TWO former chapters upon this interesting theme we furnished our readers with details of the various processes through which the precious metals pass in their progress from their native condition to that desirable shape in which they are recognised²² as current coin and "legal tenders."

The last operation we witnessed was that in which the finishing stroke was put upon the coin, and the impression given which forms its distinctive character. We will now continue our sketch at the point at which we quitted the subject last week.

When the coins came from the presses they are gathered together and carried into an adjoining room, where they are counted, weighed once more in bulk, and then put into linen bags ready for delivery to the banks and heavy depositors of bullion.

There is an ingenious and simple machine here for counting coin.⁵⁵ For counting small coin and cents this contrivance is important in saving time and labor. The machine is simply a board divided into compartments by narrow strips, which are placed at regular distances to suit the size of the coin it is designed to count.

The workman sits in front of a large box containing coins; a scoopful of the bright new pieces being placed upon the counting board, a shake or two causes them to settle into the narrow spaces between the strips, and fill up closely all the vacant space; a hinged sections let down at one end, and the superfluous pieces fall back again into this box; the workman casts his practised eye along the glittering surface, and detects at a glance any fugitive pieces that have remained upon the single layer of coins.

In less time than it requires to read this description, one thousand pieces are counted and deposited in a metallic box with the aid of a stationary wide-mouthed funnel, which has its place near the counting apparatus. To "make assurance doubly sure," the contents of each box are weighed before they are put up in the bags before spoken of.

WE NOW HAVE FOLLOWED up the course pursued by the gold and silver bullion from the time that it went into the institution. We have accompanied it in its weary and painful pilgrimage from the time it entered the Bullion Room, on the western side of the front building, until it has made its appearance, bright, beautiful and desirable, in the room appropriated to paying persons who have claims upon the institution.

With a great deal of propriety this apartment has been located immediately in the front room of the building, upon the eastern side of the main entrance, and opposite the room in which the bullion was received. The metal has gone completely round the building, and has passed through almost all its many rooms.

Assayed here, melted there, hammered at one spot, rolled in another, drawn and worse then quartered in a third, and finally, after being eaten with acids, tortured by fires, chilled with cold water, and filed and clipped and mangled in various ways, it finally reaches the Paymaster's quarters, preparatory to starting on its strange career through the world.⁵⁶

It is a curious thing to trace the manufacturer of coins from bullion; but the story would be infinitely more strange if we could record the part each individual piece would fill in the busy world.

IN THE LARGE ESTABLISHMENT like the Mint of Philadelphia, where gold and silver worth nearly fifty-three millions of dollars are coined annually, great care must be taken to avoid wastage; a very small percentage of loss on such immense operations would amount to a very heavy sum.

As an illustration of our remark, we might mention the fact that the water in which the young ladies, who are engraved in the adjusting Room, washed their hands, was preserved separately for a space of ten months, and yielded three hundred and seventy dollars worth of gold at the expiration of that time.⁵⁷

All the sweepings of the rooms, the ashes from the furnaces, the worn-out crucibles, and, in fact, everything that gold or silver comes in contact with, or amalgamates with, in its journey through the Mint, are carefully preserved and refined, to prevent any portion of the precious metals from being wasted.

The clothes worn by the workmen, while at their labors, are all burned, along with the sweepings, preparatory to being refined. The first step after the sweepings are burned, is to grind the ashes to a powder; this dust is then carefully sieved, and all the portions of metals which have run together and formed into globules while exposed to the fire, are gathered out; the ashes are then washed in precisely the same manner as the auriferous soil of California is washed to extract gold dust.

After all has been obtained that it is possible to extract in that way, the mud is dried and barreled up, not to be carted off to fill up hollows in new districts, as the reader will probably imagine, but to sell to the French "sweepers," who, through the advantages of cheap labor and high skill in the art of refining, are enabled to find the golden needle in the stack of dirt, and to extract a figurative grain from a metaphorical bushel of chaff.

After all the metal that can conveniently be obtained from the sweepings has been extracted at the Mint, the balance is assayed, and the value of the mass is thus precisely ascertained. It is no unusual thing to sell \$20,000 worth of sweepings at one time.

The French "sweepers" mingle the mass of refuse with cheap flaxes [fluxes?], and manage to extract almost every particle of the precious metals which it contains. There are many curious contrivances at the Mint to prevent waste, and to secure every stray particle of metal.

All the water used for washing by the persons employed in the establishment, runs through pipes into large tubs in the basement. These receptacles have no opening whatever in them, and the tops are covered with several thicknesses of lines, through which the excess of water must force itself.

The specific gravity of gold and silver is greater than water, and these metals consequently settle at the bottom. The canvas strained on the top of the vessel, prevents the escape of any stray particles which might be thrown upwards during a casual agitation of the fluid.

THE MANUFACTURE OF DIES used for giving the impression to the different denominations of coins is obviously an important branch [function] of the institution.⁵⁸

The engraver and die-sinker must not only get up a die which will be a tasteful piece of workmanship and reflect credit upon the country, but he must produce something that will set at defiance, as far as practicable, the arts of the counterfeiter; at the same time he must gauge [sic! gauge] his work with such mathematical certainty that his die will be neither too large nor too small for the coin to be stamped.

The difference of the thickness of a single hair in the size of a die would make a very material difference in the value of the coin. Each piece must be exact in its circumference and thickness, or the labors of the coiner go for nought.

We are satisfied that we will cause an emotion of surprise in the majority of our readers when we assure them that a die is frequently worn out in a single day in the extensive operations of the Mint.

We had innocently imagined, until our visit to the institution, that a die was engraved and dated for each denomination of coin, and put in service at the beginning of the year, and kept in constant operation, without change, until the close of the year, when a new die, with a different date, would be needed, and the old one would then be thrown aside.

It is a somewhat remarkable fact that, although a coining press will wear out a die in a single day, but one die is engraved for each denomination of coin, and serves for

very many years. We will endeavor to explain this seeming paradox, and will furnish an outline of the modus operandi of producing dies.

When an order was received from Washington directing the coinage of gold dollars,⁵⁹ a design for the new coin was first drawn, a model many times greater than the size of the proposed coin was then formed in prepared wax. When this was perfected, a casting from the pattern was carefully taken in copper or some hard metal.⁶⁰

The design, having been transferred to copper, the metallic copy of the waxen pattern is then carefully freed from all extraneous particles, and it is nicely "touched up" by the engraver.

The design has now to be transferred to steel, and must be much diminished in size. To effect this object, the portrait lathe⁶¹ is put in requisition. This is an ingenious contrivance, and works upon the same principle as the curious turning lathe which will turn out lasts of gun stocks in exact imitation of a given pattern.

When a steel die is to be produced from the copper pattern, the latter is fixed on the portrait lathe; a piece of the best steel, well softened, has already been prepared the size of the required die; that is fixed upon its appropriate place on the lathe, and the machine is set slowly in motion.

A metallic point traces over the face of the pattern, and causes a finely tempered tool to imitate every motion of the point, and delicately carve out upon the soft steel an exact miniature counterpart of the copper pattern.

The operations of this machine are exceedingly beautiful, and the contrivance itself is a complete triumph of human art. After the portrait lathe has finished its task, the steel die is placed in the hands of the engraver, who gives it any aid it may require from his graver.

THE DIE IS NOW to be hardened. To accomplish this end, fire and water are necessary. The die is taken into the basement of the building, and, after being shut up closely in an iron box, which is furnished with two lids, to exclude the air, it is put into a fierce fire to become red-hot.⁶²

While it is attaining that desirable condition, we will describe another part of the hardening apparatus. There is a reservoir at the extreme top of the building, in which a supply of cold water is kept. From this reservoir a pipe conveys the aquatic element into the basement, near to where our die is being heated.

As soon as it -- the die -- becomes red hot, it is taken out of its warm quarters and placed at once directly under the aforesaid pipe; a spigot is turned, and the water rushes

out at tremendous rate, chilling the steel most thoroughly and expeditiously. This was the object of the cold douche bath.

A heavy head of cold water is found to be more effective than throwing the metal into a vessel containing water. By the latter plan, the hot steel warms the water in its comparatively slow rate. By the other process, the water no sooner strikes the steel than it is thrown off again, and is replaced by another charge, and so on until the chilling is effected.

The die -- the manufacture of which we have attempted to describe -- is not to be used for direct coining purposes. It is elevated at once to the dignity of a standard original die; it is stowed carefully away in the fire-proof [vault], and is only brought out when its services are required to manufacture a "hub,"⁶³ which is the technical phrase applied to another agent in the production of coin, and one, too, which is intermediate between the original die and the common working article.

The reader will bear in mind that no date has been placed upon the die. We will now endeavor to explain the operation of making a "hub," and will give an idea of its uses. The "hub" is made of a piece of soft steel, and upon it an impression is struck from the original die.

After receiving the exact impression, it is submitted to the action of the furnace and the cold bath in the basement. From this "hub" the dies in every day use are struck; they are then dated by the engraver, and finally made ready for use by the hardening process already described.

The face of the softened steel upon which the impression is struck is not flat, as might be supposed; it is convex, or rather conical, with a very palpable point in the centre.²² We have been assured that this peculiar form is necessary, but we are unable to give any reason for it.⁶⁴

A great number of stout blows under a hand-press⁶⁵ are necessary in producing a working die, and the metal requires considerable annealing⁶⁶ during the progress of the work.

THE MOTIVE POWER employed in this extensile [extensive?] establishment is furnished by three steam engines.⁶⁷ These engines will rank with any in the world in point of beauty, the ease of their movement, power, safety, and, in fact, in every desirable qualification.

There is a high-pressure horizontal engine, of fifteen horse power, in operation at the Mint. The fame of this exquisite piece of machinery is wide spread, and machinists from all parts of the Union visit the institution to see it in operation. Every part of the

engine is finished in the most elegant manner, and even the most ordinary portions of the workmanship have an importance given them by the elegance of the design.

Such is the superior character of the workmanship upon this *chef d'oeuvre* of mechanism, and the consequent absence of noise in its operations, that when the visitor closes his eyes it is impossible to know whether or not the engine is in motion, although in the same apartment with it. It is absolutely noiseless, and so free from dirt that it might be set in operation in the most splendid drawing-room in the city, without injury to the carpet or furniture.

This celebrated engine was constructed in 1838, under the direction of Franklin Peale, Esq.,⁶⁸ the Chief Coiner. We have been assured that to Mr. Peale the country is indebted for many important improvements in the presses, &c., in use throughout the institution, and for the production of the most splendid triumphs of the machinists' handiwork.

The heavy work of the Mint is performed by a combined steeple engine of ninety horse power. This is also a beautiful piece of machinery. It has been in use about eighteen months.

THE CABINET OF COINS AND MEDALS in the possession of the Mint is not behind other branches of the institution in point of interest.⁶⁹ A suite of rooms on the second floor in the front of the building have been appropriated to this use. They now form a single apartment sixteen feet wide and fifty-four feet long. The center of the room is lighted by a sky-light, and is ornamented by a dome, which is supported by four columns.

Eight cases, which are placed erect against the wall, are appropriated to the ancient coins, which are united in pairs. The coins of the United States are placed in cases, which occupy a horizontal position and form a circle around the dome.

The cases around the sky-light also contain other modern coins than those of the United States. Other cases, appropriated to modern coins, occupy an upright position around the walls. This fine numismatic museum was commenced in June, 1838. It now comprises about four thousand specimens of modern and ancient coins from all parts of the world.

It is no part of our plan to enter into a detail of the rare specimens of coins in this cabinet. We will only say that history, the advancement of the arts, and the growing greatness of our own country, are elegantly illustrated by this fine collection of specimens.

There are a number of rare and curious American coins in the collection. Among them are the Massachusetts silver coins of 1652; the silver coins of Lord Baltimore, struck about the year 1662; the colonial brass coins of the Carolinas, and the ancient copper money of Virginia; the variety of copper coins struck by the different States after

the revolutionary war had ended, and before the adoption of the Federal Constitution; the New York doubloon, coined in 1787; the varieties of copper coins bearing the head of Washington and the date of 1792.

The trial pieces of the infant National Mint are to be found here, and an immense variety of different specimens of various American coins, some of which were not approved by the department at Washington.

The glass cases in the Coin Room also contain valuable specimens of the native gold, silver, and copper, of different parts of the Union; deposits of gold mingled with copper and silver alloy, in varied proportions, and a great variety of other and appropriate matters. The walls are decorated with sundry views of scenes at the Australian and California "diggings."

In the Coin Room, the great scales and standard weights are also kept. In February of each year, a commission,⁷⁰ appointed the high magnates of the Government, meet at the institution, and verify the weights in use by comparing them with the standard scale and weights, which are kept in great state in velvet cases and under glass [sic! glass] covers.

The commission is also required to assay the coin issued during the past year; but, as the gentlemen composing that important body are usually very inexpert in the profound mysteries of the assay, the performance of that portion of their duty is doubtless a pleasant fiction.

WE HAVE NOW given our readers an insight into every matter connected with the Mint, which, in our estimation, possessed sufficient interest to arrest the attention of the reader. We have made some inquiry into the history of the institution, and will furnish our readers with the result of our researches.

As early as the year 1652, a Mint was established at Boston. It was discontinued in 1686, and again opened about a century afterwards. In 1662 a Mint was established in Maryland by Lord Baltimore.

Connecticut, Virginia, Vermont, Pennsylvania, New York, and New Jersey, also established Mints, or at all events coined money. Many of the copper coins of those States are still in existence, and are met with occasionally in circulation. The coins issued by these irregular establishments were generally copper, and they were gotten up to meet the demand for that species of coin.⁷¹

THE FIRST NATIONAL MINT in the United States was established in Philadelphia by an act of Congress passed in April, 1792. The building in which the institution was first located is still standing at 29 North Seventh street. In 1829 the present marble edifice, at

the corner of Chestnut and Juniper streets, was begun, and was completed the following year.³

It presents a front of one hundred and twenty-two feet, divided into a portico sixty-two feet long, and two wings, each thirty feet. The portico contains six fluted columns, each which is three feet in diameter, and twenty-five feet in height. The building is of the Ionic order of architecture, and was modelled after a celebrated Grecian temple on the river Ilissus, near Athens. The rear of the Mint, on Olive street is also enriched with fluted columns.

The beautiful structure at present occupied by the Mint, presents a strong contrast, in respect to size, convenience, and general appearance, with the obscure and humble building in Seventh street, in which the establishment was originally located.

The old rough-cast house in Seventh street has fallen from its high estate, and it is now used as workshops by different handicraftsmen.⁷²

There is a tradition extant that the first building used in Philadelphia for the accommodation of the Mint was located on the south side of Mint court, which runs from Raspberry lane, between Cherry and Race streets and above Eighth. We are assured that there is no substantial ground for this belief.

Before Congress had passed the Act of April 1792, authorizing the creation of a Mint, artists were engaged in getting up dies for the approval of the authorities. John Harper,⁷³ an extensive manufacturer of saws, who was then located at the corner of Sixth and Cherry streets, caused dies to be engraved under the direction of Mr. Robert Birch. It is believed the dies were mainly executed by a German artist in the employ of Mr. Birch.

From these dies most of the Washington cents were probably struck. Those of 1791 were manufactured in the cellar of the premises occupied by Mr. Harper, on a press supposed to have been imported from England by him.

The coins of 1792 were struck on a press fitted up in an old coach shop, in Sixth street, near Chestnut, directly opposite Carpenter street. The latter press was manufactured at Mr. Harper's own expense, under the supervision of Mr. Adam Eckfeldt, who was afterwards, for many years, the chief coiner of the Mint.

There were but few of the Washington cents coined. The idea of placing the effigy of a public man upon the coin of the country met the decided disapprobation of Washington himself, and the dies were destroyed.

It is said that an English manufacturer at Birmingham, England, sent to this country, by way of speculation, a lot of copper coins bearing the effigy of Washington. We have no means of ascertaining the truth of this story. It was done, the experiment proved a lamentable failure.⁷⁴

The first issue of copper coins by the national Mint was in 1792; the first issue of silver was in October 1794; and gold was first coined in July, 1795.

In 1792, before the Mint was ready to go into operation, General Washington deposited one hundred dollars in silver bullion, which were coined, at his request, into half dimes or "dismes," as they were called at that time. These "dismes" were struck in the cellar of Mr. Harper's saw establishment, at the corner of Sixth and Cherry streets. The coining machinery of the newly established Mint was deposited in Mr. H.'s cellar at that time.⁷⁵

There are a great variety of facts connected with the history of the coinage of certain kinds of money at the Mint, which, although interesting, do not necessarily require notice at our hands, in a sketch like the one upon which we have been engaged.

Coins of certain denominations have not been issued for a period, and have again appeared after a long lapse of time. The standard of gold coin was changed during the administration of General Jackson. Designs and devices on coins have been altered, and new denominations issued, and many other things have been done in connection with this interesting branch of the arts which would of themselves furnish materials for a lengthy sketch.

The discovery of gold in California has created a revolution in Mint operations.⁷⁶

WE HAVE A TABLE before us which furnishes some curious facts in relation to the coinage of gold at the Mint in Philadelphia. From it we learn that, in 1793, '94 and '95, the total amount of gold coined was \$71,485.00. In 1796 it was \$102,727.50. Between 1796 and 1849 it fluctuated much, being but little over \$3000 during one year, and amounting to more than half a million during the same space of time at subsequent periods.

In the following years it varied from \$72,000 upwards, until 1834, when it reached nearly four millions of dollars. The value of the gold coinage varied much during the years succeeding 1834 until the discovery of gold in California; since that period the operations have been very extensive. During the past year over fifty-two millions in gold were coined at the Mint in Philadelphia.

In addition to the parent establishment in this city, there are Branch Mints at New Orleans, at Charlotte, N.C., and at Dahlonega, Ga. The Mint in this city possesses facilities for coining, expeditiously and economically, a much greater quantity of the precious metals than it is probable will ever be furnished by all the gold districts throughout the Union.

The scientific attainments of the officers mechanics and artists, of the Philadelphia establishment, are attested by the superior character of the coin issued from the establishment. The people throughout the country understand this matter, and a

verdict of approbation has recently been rendered by their representatives in Congress, their late action respecting the branch asked for our modest, though somewhat rapacious sister, New York.⁷⁷

IN CONCLUDING our sketch of the Mint, we will take occasion to return our sincere thanks to the following gentlemen, to whose courteous attentions we are indebted for the opportunity of exploring the institution in all its branches [functions], and for a vast deal of valuable information respecting its varied operations: Edward C. Dale, Esq., Treasurer; Franklin Peale, Esq., Chief Coiner; Jacob R. Eckfeldt, Esq, Assayer; and William E. Du Bois, Esq., Assistant Assayer.

- end -

N o t e s

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1. Gold at that time came from California, having been discovered there only four years prior. A lesser amount of gold came from outside the country, primarily from Peru (where gold was known prior to 1526) and gold was just beginning to arrive from Australia (where it was discovered in 1851).
2. Ophir was a region mentioned in the Old Testament as a source of gold. See I Kings 10:11. The name became somewhat of a generic term for any gold mine or source.
3. The First Mint in Philadelphia was at Seventh Street below Arch Street. At the time of this article the Mint (the Second Philadelphia Mint) was located at Chestnut and Juniper Streets, it was erected in 1829 and continued in operation until June 1901 when a Third Mint, a more modern building was erected at 16th and Spring Garden Streets. (This in turn was replaced by the present Fourth Mint at Fifth Street and Independence Mall in August 1969.) See also note 72
4. Oversimplified statement of ingot casting, rolling, blanking and striking.
5. The visit occurred prior to the January 23, 1853 publication of the first of three installments of this series in the weekly publication, the *Philadelphia Dispatch*.
6. Edward C. Dale, mint treasurer, is mentioned first in the credits and perhaps the writer's guide. George N. Eckert was the Director of the Mint, and is nowhere mentioned in any of the three installments. In the year 1853 there were three directors: Eckert until April, Thomas M. Pettit for two months, April and May, James Ross Snowden beginning in June. James B. Longacre was the Chief Engraver, also nowhere mentioned; Franklin Peale, Chief Coiner is mentioned.
7. A reference to counterfeiting.
8. Unknown "gentleman" in charge of this department.
9. Is this journal book still in the National Archives?
10. Where did the tin boxes come from?
11. The wooden boxes could certainly be made from the cedar or redwood easily available in California.
12. Pre Mint sealed bags!

13. One must wonder at the labor of obtaining the gold was small in comparison to crating and carting it across a continent for deposit at the Mint.
14. [What was buying price of gold in 1853?] A \$100 minimum amount would amount to what weight of gold? [At \$35 an ounce this would be three-ounce minimum.] One dollar in 1853 would be the economic equivalent to \$13.14 in 1991 dollars.
15. Reference to a half dime -- 5/8-inch, 15.9 millimeters -- was not the smallest coin at the time; the silver three-cent piece -- 9/16-inch, 14.3 millimeters -- had been inaugurated two years earlier. But these may not have been as familiar to the reader as the half dime (in existence since 1794).
16. The standard known as Troy weight, named after Troyes of France, is the standard for weighing gold and silver in England and America. It is composed of a Troy pound of 12 ounces, 1 ounce equals 20 pennyweights (abbreviated dwt.) and 1 pennyweight equals 24 grains. The grain is the same as the grain in Avoirdupois, no other terms are equal.
17. Carat is a measurement of gems; *karat* is the correct term as the measurement of precious metal. Pure gold is 24 karats; each karat is 1/24th or 4.16 2/3% of total purity.
18. The standard at the time was 900 fine for both coin gold and coin silver and had been since 1838. (Prior to 1834 gold was 917 fine, silver coins were 900 fine). No U.S. coins were struck in 950 fine, this was given for illustrative purpose only.
19. Many of these account books still exist in the National Archives (Record Group 104) in Philadelphia.
20. [What percentage is 389 1/2 ounces to the total amount for one year?]
21. Gold does not alloy with iron (the two elements are noncompatable -- they can be mixed physically but not bonded chemically). The reference to greasing an iron mold is the application of a release agent.
22. Certain words in this article are spelled as British English, indicating perhaps the author may have been an Englishman, or, at best, trained in England. Yet "color" is Americanized. The words with British spellings are:
- | | |
|--------|----------------------|
| centre | oxydise, oxydisation |
| gramme | philosophising |
| lustre | recognised |
| mould | |
- Other grammar clues -- notably "which" versus the more restrictive "that" -- has been left intact, as has the spelling of the above British words.
23. Black sand was iron oxide found in gold dust.

24. Iridium's melting point is 2410° Centigrade (4449° Fahrenheit) -- the highest of all common metals -- probably a temperature impossible to obtain in 1853.
25. First reference to gold coins: the \$10 eagles.
26. Three-cent silver coinage alloy was 75% silver and 25% copper and struck only since 1851. In 1853 it was still a new and novel denomination.
27. Melting foreign coin was a major source for obtaining silver. Also, and more importantly, it was a major source for the coin cabinet; officers of the Mint had the presence of mind to select desirable specimens for the numismatic collection. The collection had its own curator in 1881, Richard A. McClure. Up to this time the Assayer was in charge of the coin collection. McClure was first appointed as Assistant Curator in 1861, to be replaced in 1905 by Thomas Louis Comparette. (1868-1922). Decades later, in 1923, this collection was transferred to Washington DC to form the nation's numismatic collection in the Smithsonian Institution. [Thank you, gentlemen, for your foresight. You preserved valuable numismatic specimens for future generations at the cost to the nation of the silver or metal content alone!] See also note 68.
28. How gold is extracted with use of nitric acid.
29. Legal interest: 7.3% of \$1 million would be \$400 for two day's time.
30. How silver is extracted with salt, zinc and sulfuric acid.
31. Hardly a random sample: second and next to last ingot.
32. Sir John Franklin was an arctic explorer who had recently been in the news. An Englishman who had commanded several expeditions into the Arctic, had on his latest, in 1847, failed to return. His wife Jean fitted out five ships between 1850 (and 1857) to search for the ill-fated expedition only to find evidence that Sir John's ship had been deserted and all members of the party including her husband were lost.
- A *unity* weight is illustrated in Evans.
33. Did the author mean *Der Freischütz* (instead of *Der Freysebutz*)? This was a 3-act opera published in 1821 by Carl Maria Friedrich Ernst von Weber (1786-1826). The author was being pedantic in this statement.
34. Ivan Ivanitz Chabert (1792-1859) was a performing fire-eater, known as "Fire King." Outside of France he was also known as "J. Xavier Chabert" with a string of unsubstantial medical and academic degrees.

35. Cupee is the same as cupel, a container made of potassium of lime (made from ground dried bones). The First U.S. Mint stored considerable quantity of bones adjacent to its building that this area was called "Bone Alley." These were ground up and made into cupels. See also notes 40 and 43.
36. Nitric acid again.
37. *Nolens volens* is Latin for "unwilling or willing," to do something whether wanting to or not.
38. *Aqua fortis* is the common name for nitric acid.
39. Use of muriatic acid to extract silver from silver nitrate.
40. Dry assay is a testing of a sample of ore or mixed metals to ascertain the content of the gold, or of silver. The sample is fused with lead (as a flux), then this is melted in a cupel or cupee -- a small container of phosphate of lime (made of ground dried bones). The cupel absorbs all other metals (even platinum) other than gold and silver. It leaves these as a "button" of the mixed elements. The silver is separated from the gold by dissolving in nitric acid. This process is also called cupellation -- because of the use of the cupel -- (see note 43).
41. Joseph Louis Gay-Lussac (1778-1850) is know for his Law of Gaseous Combining Volumes. A chemist, he was also noted as a balloonist.
42. Humid assay (or wet assay) is a roasting of the ore, with lime if necessary, and the extraction of gold and silver with sulphuric or nitric acid (aqua regia or aqua fortis), then a precipitation from the solution with mercury or copper.
43. Cupellation is the name of the process for extracting gold and silver from other metals by the dry assay method: melting in a cupel -- the phosphate of lime container made of bones described in footnote 40.
44. Rolling mill first mentioned. Long used by mints for reducing ingots into strips of metal prior cutting out blanks, previously by goldsmiths. It was developed by Max nSchwab in Germany in 1550 for such use.
45. Water from the Schuylkill River that runs through Philadelphia.
46. Joseph Fonché (1759 or 1763-1820) a French Revolutionist, took part in the massacre of 1793. He was indeed minister of French police.
47. No nine to five; the work day was ten hours long! According to figures mentioned here, each girl took an average of 51 seconds to weigh, file and reweigh each blank, or about one gold blank a minute. One or two workmen would be required to bring

fresh blanks to each ladies' workstation and to carry away adjusted blanks. These were carried in tote boxes, perhaps too heavy for ladies to lift.

48. Weight adjustment and the source of adjustment marks on gold coins.
49. By milling here described the author means upsetting (called "rimming" in England). This step prepares the blank by thickening the edge, rounding the edges, and making the blank completely round. This procedure aids in the feeding and prevents jams in the coining presses. High speed coining would be impossible without it.
50. Pickling is the use of a mild acid to clean a metal surface. Nitric acid is the most often employed, sometimes sulphuric acid. It removes surface tarnish and corrosion.
51. We discount this statement; presses were developed in Germany and England sixty years before, and first imported from there. We doubt any American technology went in the opposite direction back to Europe.
52. Poor definition of a *collar*. Better: a flat disk with an opening in the center, an aperture of prescribed diameter and machined on the inner wall surface to the requirements of the coin to be struck. The collar wall can be smooth (for coins without reeding) or contain flutes and furrows to impart the reeding on the edge of the piece struck within the collar. The aperture is slightly flanged (wider at one side than the other) for the struck piece to be ejected (pushed out by one die activated by an ejector mechanism).
53. Getting blanks in rows for feeding. This was a manual procedure where blanks were shaken -- or arranged by hand -- until they formed into upright rows in the corrugated troughs in the bottom of the tray.
54. The word *roleaux* is French for roll, as a roll of coins, although the author is speaking of a roll of blanks in this instance.
55. The *counting board* for manual counting is illustrated in Evans (page 40).
56. In contrast today where entire product is shipped to Federal Reserve Banks for distribution through member banks, corresponding banks down the chain to local banks.
57. An example of salvaging everything that could possible contain any gold.
58. Die preparation was done only at the Philadelphia Mint, and never at a branch mint (until a die room was equipped at the Denver Mint in 1995).
59. In 1849.

60. Prior to about 1850 the U.S. Mint made these early castings like bronze foundry castings. After the invention of *galvanoplasty* by a German, Moritz Herman von Jacobi (1801-1874), the use of electroforming was employed. A bas-relief model was used as a pattern, and the relief was formed in copper by electrolysis using primitive batteries. The *galvano* was then used as a pattern to be reduced on the portrait lathe to produce a reduction punch. The technology was brought to the United States by private industry, Rogers Brothers, 1847, for silverplating tableware. It can be assumed the Mint had knowledge of electrolysis shortly after this time.
61. The portrait lathe was a 19th century name for the die-engraving pantograph because much of its work was portraits. It would cut reduction punches for the portrait or device instead of the entire relief of an intact die which would include lettering, stars and devices.
62. Heat treating includes a number of annealing, tempering and normalizing operations.
63. Hubbing is the process of making a die in steel from a design or pattern in hardened metal (called a hub) with the intent of reproducing all the cavities of the design. It was done on a screw press set aside for this, or later, a specialized hubbing press, first called a *multiplying press*.
64. Cone blank or dome blank is used for two reasons: to spread the stress in slow advancing increments rather than the hub entering a flat surface all at once; also the cone creates more mass below the center of the die's top surface to help prevent sinking in a well-used die.
65. The press set aside for hubbing at that time was hand powered. (A hand powered screw press was used for duplicating dies since the Mint's inception). Hubbing presses were powered by steam and belting later. It was not until 1892 that the United States Mint obtained a press specifically designed for hubbing; with hydraulic action, it was powered by electricity. Hubbing presses became extremely sophisticated in the 20th century.
66. The properties of iron are such that heating and slow cooling softens, or anneals, the iron. Heating and rapid cooling (in certain environment as oil or salt) hardens, or tempers the iron. These are functions of *heat treating* which requires experience and wide knowledge of iron working and metal properties.
67. The first steam power engine was installed at the U.S. Mint in 1816 replacing horse and man power. By 1851 the Mint had three steam engines, including one heavy duty steeple engine (installed 1849) of 90 horsepower. Energy was transferred from these engines to machinery by belting. Steam power was itself replaced by electricity and electric motors when electricity became commercially available in the late 1880s (thanks in large part to Thomas Edison, even though one of the first electricity generating plants was in Philadelphia, the Mint had their own generator).

By 1892 all machines possible were powered by electricity. The new Philadelphia Mint of 1901 and the Denver Mint of 1904 were entirely electric. The steam power press went to the Smithsonian.

68. Benjamin Franklin Peale (1795-1870) was the son of Charles Wilson Peale, painter and museum founder. Franklin assisted his father and brothers at Peale Museum, manager until 1833, after which he worked for the U.S. Mint. Peale was hired by Director Samuel Moore, who sent Peale to Europe to learn mint technology from all the mints there; he returns 1834 with knowledge of latest technology, gives Moore a 272-page report [known as the *Peale Report*]. Peale begins installing this technology at the Philadelphia Mint. He obtains for the mint the new Contamin die-engraving pantograph and Thonnilier coining press, 1836; completely rebuilds this press, 1840. He strikes the Polk Indian Peace Medals in record time, 1845-1846 by using this newly installed equipment.

Afterwards Peale became an embezzler at the mint, running a lucrative business in manufacturing medals with mint bullion and machinery (in which he pocketed the proceeds). This continued for years, as one of the four families that controlled the mint (who also received some of the proceeds). He was protected by Mint Director Robert Meskell Patterson (and others), ultimately fired 2 December 1854 by President Franklin Pierce.

69. This is an early description of the coin cabinet; it was transferred to the Smithsonian Institution as the national coin collection in February 1923. See Vladimir Clain-Stefanelli, *History of the National Numismatic Collections*; Washington: Smithsonian Institution, 1968, 108 pages. See also note 27 above.
70. The United States Assay Commission is a continuation of an English tradition, the *trial of the pyx*. A committee of American citizens tested samples of coins set aside for this purpose. When coins were made of precious metal this was a form of checks and balances to insure the mint would produce coins of prescribed fineness. With the elimination of precious metals from coins -- in effect making all coins a token coinage -- the need for such testing was unnecessary. The testing of coins commenced with the establishment of the U.S. Mint in 1792, the United States Assay Commission was formalized in 1860; it was disbanded by Jimmy Carter in 1977.
71. The fact that colonial coins were still met with in circulation in 1853 is quite interesting. Reason, perhaps, so many are observed in lower conditions of wear if allowed to circulate this long.
72. The First U.S. Mint building was purchased by Frank H. Stewart for the Electric Company that bore his name and razed by him in August 1911. He was so impressed with the history of the building he wrote the book *First United States Mint Its People and Its Operations* (1924). He searched for old mint artifacts but found only some discarded planchets.

73. John Harper had cent coins struck from these dies in his coach house cellar. Supposed to bear George Washington's portrait, collectors later nicknamed them "Jefferson cents" (Breen 1678-1680). The dies were confiscated from him by Second Mint Director Elias Boudinot. (There are some questionable records that he may have been reimbursed \$100 for these, however).
74. Washington coins were issued in late Colonial times. Popular with the public then, these early issues are prize specimens among present day collectors. Most were struck in England, where, not having seen Washington, engravers portrayed the American patriot in physical appearance from Caesar to George II.
75. George and Martha Washington's inspection of the first coins struck at the new mint. This event was the subject of several paintings that graphically -- but perhaps apocryphally -- record the event.
76. We wish the author would have expanded on this statement. Hardly a revolution, the discovery of gold merely increased the quantity of gold that needed to be coined.
77. New York City, of course, was never the location of a mint, but it has come close with the use of West Point, a century later in 1974, to produce cents, and even later, other denominations, precious metal and commemorative coins. At first it carried no mintmark, (Treasury officials stated it was a sub-mint of the Philadelphia Mint). But a W mintmark was first placed on gold commemorative coins struck there beginning in 1984. ✨

List of Mint 'Rooms'

(In order of their description)

Bullion Room	2
Deposit Melting Room	4
Melting Room	6
Melter and Refiners Melting Room	7
Water Basin Room (in basement)	10
Assaying Room	15
Rolling and Cutting Room	18
Adjusting Room	20
Milling Room	20
Dressing Room, Kitchen, Dining Room ..	22
Coining Room	23
Paymasters Room	27
Engine Room.	29
Coin Exhibit Room.	30

